Autonomous Formation Flying Sensor for the StarLight Mission

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The StarLight Mission, an element of NASA's Origins Program, will demonstrate for the first time two technologies crucial to later missions: separated-spacecraft optical interferometry and precise autonomous formation flying of an array of spacecraft. After initial checkout in a heliocentric, Earth-like orbit, the two StarLight spacecraft will separate and begin flying in formation at separations between 30 and 1000 meters, without real-time intervention from Mission Operations. Operation in the separated mode will continue for about a year.

To maintain the formation and to support optical interferometry, the StarLight spacecraft require a formation sensor that can determine the distance between spacecraft to within 2 cm, measure the bearing angles to the remote spacecraft to within a minute of arc, and operate over a wide field of view. For this purpose an RF sensor, the Autonomous Formation Flying (AFF) Sensor, has been designed that operates at Ka band using technology similar to that of the Global Positioning System (GPS).

The Sensor's stringent performance requirements mandate a substantial technology development effort and a sensor with some novel features. The presentation focuses on several interesting issues concerning the sensor's design and its relationship with the rest of the spacecraft, including:

- Mutual physical, optical, and electrical accommodation of the AFF Sensor and the spacecraft;
- Electrical and mechanical stability;
- Ground- and space-based calibration; and
- Communication between the Sensor and the spacecraft.